Research Department Working Paper No:04/04

Importance of Base Money Even When Inflation Targeting

Melike Altınkemer

March 2004

The Central Bank of the Republic of Turkey

IMPORTANCE OF BASE MONEY EVEN WHEN INFLATION TARGETING*

Melike ALTINKEMER

THE CENTRAL BANK OF THE REPUBLIC OF TURKEY
Research Department
March 2004

*The views expressed here are my own and do not necessarily represent those of the Central Bank of Turkey. I am thankful to DevrimYavuz for helping me with the data, to Kivilcim Metin for clarifying seasonality issues and to Erdal Ozmen for taking time to read my paper and for his very helpful comments.

Abstract
As monetary targeting lost its credibility and began to be replaced by inflation targeting, more and more countries chose to inflation target. Meanwhile the role of money is completely forgotten. This paper investigates the existence of a stable long run base money demand and try to show that money could play at least informational role even for a country like Turkey who is at the present implicitly inflation targeting and heading along the direction of explicit inflation targeting. When the fragility of the banking sector and fiscal dominance problems are solved and when the central bank can increase the overnight interest rates if the need arises without jeopardizing either the fiscal balance or the banking sector balance sheets, the conditions for inflation targeting will be there. For now, base money is still our best bet in monetary policy.

I. INTRODUCTION

In the 1970's, inflation was accepted basically as a monetary phenomenon, there was a causality relation between money and prices and hence to achieve price stability monetary targeting was used. However, in time, continuous overprediction of real balances, as well as difficulties in explaining or predicting movements in velocity, led to the conclusion that money demand was unstable and its relation with price level was broken. Several reasons were attributed to this instability; one was financial liberalization and financial innovation, another was currency substitution, yet others were institutional reforms, regulation, deregulation. Martina Copelman(1996) investigated the effects of financial innovation on money demand for Bolivia, Venezuela and Israel and showed that by increasing the speed of adjustment to money demand and its determinants, financial innovation can lead to money demand instability.

Siriram(1999) claims that the second major reason contributing to money demand instability was the inadequacy of partial adjustment models used in estimating money demand. Engel and Granger (1987) indicated that these models, by ignoring the stationarity properties of the data may lead to incorrect specification and misleading conclusions.The existence of lagged dependent variable and the adjustment cost for the actual level to reach the desired level was suspected to cause the observed instability. Hence, apparent fragility of money demand in recent years may not only be stemming from the institutional changes in financial markets but also from the apparent inadequate modeling of the transmission mechanisms.

The search for solutions to improve the econometric problems associated with partial adjustment models eventually led to error correction models.

Whatever were the reasons for the acclaimed failure of monetary aggregates, recently the trend has shifted from monetary targeting to inflation targeting. Although advocates of inflation targeting regime claim that the central banks should not take into account the movements in money in formulating monetary policy (Estrella and Mishkin (1997), Bernanke et al (1999), Svensson (1999)), monetary aggregates could still play several roles and hence it may be useful to follow their developments closely for central banks even in inflation targeting regimes. According to Soderstrom (2001), it could help stabilizing expectations in a model with forward looking expectations. Additionally, monetary aggregates could also play 1)Indicator role for future inflation 2) Information role regarding other variables that influence inflation 3)Transmission role for credit channel given that money and credit are closely related.

Soderstorm (2001) argues that ECB gives a prominent role for M3 by taking its growth rate as a reference value for the conduct of monetary policy in the pursuit of its price stability goal. He claims that there is scope for using money growth target to improve on discretionary monetary policy, which inflation targeters resort to.

Altimari (2001) has investigated leading indicator properties of different money based indicators in predicting future inflation and compared it to other leading indicators of inflation, their result support the view that monetary aggregates provide significant and independent information for future price developments.

Given this background and also given the fact that Turkey is heading in the direction of inflation targeting, this paper will investigate the existence of a stable long run base money demand using Johansen cointegration tecnique. In this respect, section II will give background for Turkish monetary targeting experience. Section III will describe the long run base money demand equation with IIIA on short run dynamics of inflation equation. Section IV and IV A will discuss broad money namely Real M2Y cointegration results and its short run dynamics in term of inflation, section V concludes.

II. BACKGROUND

In Turkey starting from 1986, the Central Bank began monetary programming exercises unofficially, i.e. they were not announced to the public due to likely credibility loss in case of not meeting the targets. It was through these exercises, that came the understanding that for any monetary programming to be successful, it was first necessary to discipline the public finances. In Turkey, inflation was widely believed to be a fiscal phenomenon and it was thought that the monetized budget deficits that was the main cause of inflation.

To this end, the Central Bank signed a protocol with the Treasury in 1989 to limit the Treasury borrowing from the Central Bank and following that, the first official monetary programming was announced in 1990. With this program, the Central Bank aimed at controlling its own balance sheet and successfully implemented the program till the break out of the Gulf War in 1991 which rendered any programming ineffective.

In general, monetary programming in Turkey was interrupted either through a foreign shock like the Gulf crisis in 1991 or domestic shock like elections in 1992,1995 or 1996 or financial crisis as in 1994.

Needless to say, worsening of public finances was the main reason behind all unsuccessful monetary programs. Like in 1992, even though a monetary program was announced, increasing public sector credits carried over from 1991 went out of control. Increasing the liquidity in the market and the resulting increase in open market operations and foreign exchange interventions, increased the Central Bank liabilities in 1993 which again rendered any programming ineffective and hence instead of trying to implement the program, the Central Bank chose to minimize the fluctuations in exchange rates.

In addition to the macro imbalances, government's interference in the securities market by canceling auctions to decrease Treasury interest rates, triggered the 1994 crisis and culminated in April 5 stabilization package. As part of the package, a one-off tax, coupled with increases in public prices corrected the budget deficit but had pushed the inflation rate over 150%, stagnated the economy with 6 % GNP decline. The situation improved in 1995, with growth and foreign reserves picking up, inflation and current account declining, till the last two months of 1995 with the call for early elections which again increased the public spending, led to the expansion of the domestic assets of the central bank and hence inflationary expectations. In such periods when no explicit target is in the horizon or the implementation of the program becomes difficult, either due to political uncertainties or to increasing public sector credits or foreign originated crisis or the like, the Central Bank, mainly focused on the smooth functioning of the financial markets. 1996 was a politically unstable year, the coalition government which took 3 months to form followed a tight monetary policy but public finances were getting out of hand, hence increasing public prices with increasing inflation was the only way out, finally coalition government collapsed in the middle of the year. Hence in such a politically unstable environment with weak coalition governments and increasing public sector deficits, the Central Bank again had an internal, but publicly unannounced monetary and exchange rate policy. In both 1996, and 1997, the Central Bank tried to limit the increase in domestic credit to the public and allowed the

increase in reserve money to be in line with increases in net international reserves, while following more or less a real exchange rate rule. Between 1994 and 1997, the growth rate of domestic assets has slowed down gradually, declined by 48% in nominal terms. In fact, short term advancement facility between the Central Bank and the Treasury totally closed down in July due to a protocol signed by the two institutions.

In 1998, for the first time, the budget was designed to have a primary surplus and monetary policy was supportive of the fiscal policy and chose reserve money as the target variable, again the source of the increase of reserve money was designated to be the increase in foreign assets. In the second half of the year, following an agreement with IMF, the targeted variable was changed from reserve money to net domestic asset, the reason being the possible unpredictable shifts in money demand due to decreasing inflation. Throughout the year, the Central Bank remained within the target, in spite of the Russian Crisis, which reversed the decreasing interest rates trend at home and made it difficult for the Treasury to borrow both internally and internationally. The real effects of the Russian crisis were felt more in 1999 in the Turkish economy, GNP growth rate declined due to demand shortage and high real interest rates caused fiscal position to deteriorate. In addition, political uncertainty regarding elections as well as a major earthquake made it a difficult year, however, increase in capital inflows made it possible for domestic assets to grow in line with the target regardless of these difficulties.

Nevertheless, the urgency of the economic situation forced the Central Bank to adopt an IMF supported major stabilization and disinflation program at the end of 1999 based on exchange rate targeting. The program envisaged a quasi currency board system with preannounced exchange rate depreciation as well as performance criteria on net domestic assets, assuming that the base money demand increase would be met by increase in net foreign assets. Initially the program was credible and successful in meeting the targets, in reducing interest rates, however, towards the end of the year, growing current account deficit as well slowing down of privatization efforts, lowered the program credibility, creating doubts regarding its sustainability. Mini crisis lived in November exacerbated this loss of confidence, carrying it to the next year. Finally, in 2001, the spread of the liquidity shortage of one bank to the others triggered the banking crisis in February, skyrocketing the interest rates, as well as increasing the demand for foreign exchange, finally forcing government to abandon the program, letting currency to float. After the crisis, in the first four months of the year, The Central Bank could only try to stabilize the markets, helping banks to meet their financing needs by lowering short term rates, meeting the overnight borrowing needs of public and fund banks so as to prevent it from crowding out those of the others in the system, trying to meet foreign exchange demand of banks who were caught with open positions by the crisis, by regularly opening foreign exchange sales auctions and the like. Starting from mid May, the Central Bank announced that till the conditions for inflation targeting regime were realized, the Central Bank was going to target base money as nominal anchor. In the rest of the year, preparations slowly in line with inflation targeting were made. First, the Central Banking law was passed which would render its independence, which is a must for inflation targeting regime, and the Central Bank changed short term interest rates in line with inflationary expectations in preparation for the inflation targeting regime. In 2002, while the effect of the crisis was still felt, again base money was chosen as the nominal anchor as well as the performance criteria together with net international reserves. The sustainability of domestic debt was creating confidence problem in the beginning of the year, but strong adherence to the program as well as financial support provided by IMF helped to overcome this problem, credibility was gained back which reduced inflation as well as inflationary expectations with the help of weak domestic demand, which also facilitated the Central Bank to lower short term interest rates. The second half of the year till November was characterized by uncertainty

regarding political elections. After November, that was cleared, the targets were met and short term interest rates were lowered even more. In 2003, the conditions for inflation targeting was still not ripe, hence the Central Bank continued using implicit inflation targeting. In this respect, base money was chosen as performance criteria together with net international reserves floor. At the present the Turkish economy, although in a much better shape than before, is still suffering from fiscal dominance, banking sector is still fragile, both of which implies the asymmetric use of overnight rates which is one of the basic tools of monetary policy in inflation targeting i.e. it is all right to decrease the overnight rates but if they have to be increased which inflation targeting may require that is going to pressure both the fiscal position and the banking sector.

III) LONG RUN REAL BASE MONEY DEMAND

To estimate the long run real monetary base, Johansen(1988) cointegration methodology is used. The variables used are real monetary base, where base money is deflated by cpi, monthly GNP interpolated from quarterly series using Fernandez(1981) methodology and opportunity cost variables, namely, treasury bill rate, exchange rate depreciation and forward inflation assuming rational expectations. Data is monthly, seasonally unadjusted and covers the period from 1992:6 to 2003:9.

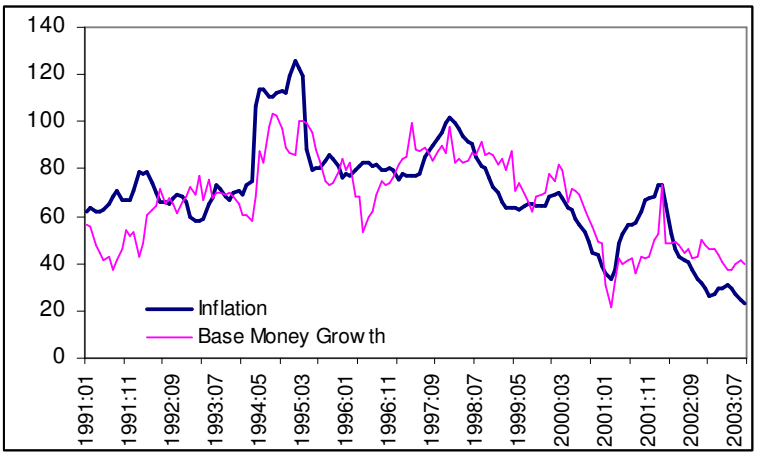
For the opportunity cost variables monetary theory for the portfolio decision indicates to use variety of returns for alternative assets. However for econometric considerations like collinearity, usually one representative rate is taken into account. There is a debate over the use of short term or the long term rate as the representative interest rate for money demand among the economists. Ando and Shell (1975) who assume perfect capital markets, argue for the inclusion of short term rate. They claim that the rate of return for the long term assets determine the allocation between such assets but does not influence money demand while Baba et al (1992) in their work showed that if capital market imperfections are included in Ando and Shell model, the long rate influences the money demand.

In practice this question has to do with the amount of debt stock, fiscal sustainability and the level of inflation the country is experiencing. In this paper, the long run rate, 3 month treasury bill rate (mtbill) is used for the simple reason that inclusion of overnight rates gives a positive sign with real base money demand which would imply for example, in the case of monetary tightening, the higher the overnight rate the more money is demanded which is a rather perverse result, but inclusion of treasury bill rate gives the proper negative sign as expected.

The other opportunity cost variables inflation and exchange rate enter into the equation as forward change assuming rational expectations i.e. that agents expect in period t, the inflation that will materialize in (t+1)st period. The same is assumed for exchange rate depreciation. The reason being, that treasury bill is a future yield on monthly assets holding, so for inflation and exchange rate depreciation to be comparable to monthly treasury bill yield it has to refer to the same period, not to the past. Also, in inflation targeting, expected rather than actual inflation is used.

The reason for including inflation in addition to interest rates is that, those two variables do not necessarily follow the same path exactly. Laidler (1985) argues that variation in interest rates do not fully reflect variation in expected inflation rate for some unexplained reason. Hence this leaves a room for interest rates as well as expected inflation rate to play role in demand for money function. The same is also true for exchange rate depreciation, exchange rates may react to a shock while it may take some time for inflation to react, since pass through is not always the same but may be varying, depending on the nature of the monetary policy rule and the shocks to which economy is exposed. High inflation does not necessarily

mean high pass through. In addition exchange rate depreciation can be an indicator of currency substitution and hence has a role in money demand function.



Base money is calculated as the sum of currency in circulation, required reserves and free deposits and is deflated by CPI. Given the monthly treasury bill (mtbill), change in exchange rate (Δlexf), inflation expectations (inff), real monthly gnp (lrgnp) and 11 seasonal dummies, real base money demand (lrbm) is tested for cointegration using Johansen (1988) procedure. Before going ahead with the estimation, the variables are checked for stationarity. Table I which gives the result of likelihood ratio tests where null is stationarity, indicates that all the variables are nonstationary (have values greater than chi square 5% critical value of 9.40)
To check whether that nonstationarity means they are I(1) or I(2), Dickey Pantula(1987) procedure for higher order is applied i.e variables are first checked for differences then for levels and the results indicate that they are all I(1)(Table II)
Table III indicates that null of 0 cointegrating vectors against the alternative of greater than or equal to 1 cointegrating vector for base money is rejected both by the 99% and 95% critical value for the trace test and that there is one cointegrating vector is accepted.

Cointegrating Equation Normalized for real base money(LRBM) is

LRBM = -0.806 MTBILL –0.926 INFF –0.243 ΔLEXF +0.850 LRGNP

Optimal lag length using VAR sequential system reduction procedure gives 15 lags according to likelihood ratio test. Weak exogeneity results indicate (Table IV) that real gnp and treasury bill rate are weakly exogenous, inflation and change in exchange rate marginally pass the chi square critical value at 5%, and hence endogenous, real base money is also endogenous. The results also show that real base money is positively related to real gnp and negatively related to opportunity cost variables as expected. The long run equation passed all the autocorrelation tests (see appendix) and failed to pass normality but cointegration results are robust to excess curtosis (Gonzalo 1994).
To check for the stability of the cointegrating relation, recursive estimation along the lines of Hansen and Johansen (1993) is used. They suggest using recursive estimation analysis as a misspecification test for possible nonconstancies. The graph in the appendix, where test of known beta equation to beta(t)is shown, there are two representations. The Z representation where all the parameters in the model are reestimated in each period, and the R representation, where short run parameters are fixed and only long run parameters are reestimated. The R representation and the plot of eigenvalue which lies between the 95% confidence bands

support the conclusion of constant cointegration space and constant cointegration rank. Previously Ozatay (1997) has tested the existence of a long run stationary reserve money for Turkey between 1977:1 and 1995:III with quarterly data and found that stationary long run reserve money exists for Turkey inspite of the rapidly changing financial environment in which the estimation takes place.
As a separate exercise to isolate the effects of change in required reserves on base money, a fictitious base money is calculated where required reserves are assumed to be constant at %3 throughout the estimation period. Then the calculated base money is tested for cointegration using the same variables as in the case of actual base money. The results indicate that calculated base money (LRBMC) has lower elasticity for all the variables except for real gap as reported below.

LRBMC = 7.57- 0.623MTBILL –0.303 INFF –0.109 ΔLEXF +0.954 LRGNP

In addition, the error correction coefficient for the change in short run inflation to a disequilibrium in the longer run is much faster with calculated base money with -.979 than with actual reserve money with -.466 (section IIIA) which indicates that the adjustment is almost instantaneous, so it may be possible to conclude from here that it is the change in reserve requirements not only as a ratio but also as coverage that slows down speed of adjustment of inflation to a long run disequilibrium in base money demand[1].

III.A) THE SHORT RUN DYNAMICS

The cointegration approach can also be used to estimate the short run equations. According to the representation theorem by Engel Granger (1987) cointegrated variables can be represented by error correction representation.
Using the error correction term from the long run actual real base money equation, short run reparametrized inflation equation is written as follows:

$$\Delta INF = \underset{(-2.193)}{-0.466}\,[EC]_{t-1} + \underset{(2.271)}{0.997}[\Delta\Delta LEXF]_{t-1} + \underset{(2.546)}{0.574}[\Delta INF]_{t-2} + \underset{(2.880)}{0.415}[\Delta\Delta LEXF]_{t-2} + \underset{(3.321)}{0.710}[\Delta INF]_{t-3}$$

$$+ \underset{(3.748)}{0.011}[\Delta\Delta LEXF]_{t-3} + \underset{(2.806)}{0.606}[\Delta INF]_{t-4} + \underset{(3.028)}{0.854}[\Delta\Delta LEXF]_{t-4} + \underset{(1.99)}{0.422}[\Delta INF]_{t-5} + \underset{(3.223)}{0.096}[\Delta\Delta LEXF]_{t-5}$$

$$+ \underset{(3.012)}{0.325}\,[\Delta\Delta LEXF]_{t-6} + \underset{(1.98)}{0.569}\,[RBM]_{t-7} + \underset{(2.522)}{0.466}[\Delta\Delta LEXF]_{t-7} + \underset{(3.859)}{0.178}[\Delta\Delta LEXF]_{t-8} + \underset{(2.082)}{0.273}[\Delta\Delta LEXF]_{t-9}$$

$$+ \underset{(2.133)}{0.230}[\Delta\Delta LEXF]_{t-10} + \underset{(3.033)}{0.051}[\Delta\Delta LEXF]_{t-11} + \underset{(2.884)}{0.512}[\Delta\Delta LEXF]_{t-13} + \underset{(2.023)}{0.325}[\Delta INFF]_{t-14}$$

The significant coefficients in change in inflation equation indicates that short run inflation is explained among other things by inertia i.e. its own lag starting from 2nd lag to 5th lag and the 14th lag, however, change in depreciation has even more lasting affect on it all the way till 11th lag and the 13th lag, change in real base money affects change in inflation with its 7th lag. The error correction alpha coefficient for inflation equation is significant and negative

[1] The short run equation for inflation for calculated base money case is mainly determined by lags of change in inflation as well as lags of exchange rate change, both of which are persistent with 8 lags, as well as lags 11,12,13

with a magnitude –0.466 which is not significantly different from 0.5 which implies that the adjustment to long run equilibrium through inflation is not slow but rather moderate.
Granger(1986) states that if a pair of I(1) series are ointegrated there must be causation in at least one direction, as one variable can help forecast the other. Also, again according to Granger(1988)when there is cointegration between I(1)variables, Granger causality testing requires using the error correction term from cointegration. Granger causality tests done according to this procedure with error correction term indicates that there is a bivariate causality between real base money and inflation with 1 lag, i.e. real base money growth Granger causes change in inflation with 1 lag and change in inflation causes real base money growth with 1 lag[2].

This study finds that change in inflation is mostly affected by inertia i.e its own lags and and by change in exchange rate and the latter effect is rather persistent. Earlier work done on Turkish inflation concentrated mostly on budget deficit since it was widely believed in Turkey that the cause of inflation was fiscal rather than monetary. Metin(1998) investigated the relation between inflation and budget deficit over the1950-1987 period with annual data and found that budget deficits as well as real income growth and monetization significantly affect inflation. She had reached similar conclusion in her earlier work (1995) where she examined the contribution of monetary, government, goods, external and labor sectors to inflation. Her results indicated that fiscal expansion dominated the determination of inflation while the excess demand for money affected inflation only in the short run. Imported inflation and excess demands for assets in capital markets had some effects on cpi but goods market had no effects.
A more recent study on Turkey by Ozmen and Koru (2003) however, investigates the long run relation between budget deficit, inflation and monetary growth for the narrowest (currency in circulation) and the broadest monetary aggregate(m2y) using quarterly data for the period 1983:1 to 1999:4. Their findings that both money and inflation are endogenously determined, rejects the quantity theory of inflation for Turkey and their data does not support the direct relation between inflation and budget deficits.

IV. LONG RUN DEMAND FOR REAL M2Y

A similar long run demand function is estimated for Real M2Y. M2Y has in addition to currency in circulation, demand and sight deposits, foreign exchange deposits in it. Johansen test results indicate that for real m2y, there is one cointegrating vector only at 90% according to trace test results (table IV).

Cointegration equation for long run real m2y is

LREM2Y= -18.445+0.966 LRGNP+0.310 MDEPRATE- 0.425 MTBILL-1.310 INFF+0.659ΔLEXF
.

[2] Δınf = 0.0031-0.42Δinf(-1)+0.14Δlrbm(-1)+-0.009 EC(-1). All the terms are significant. Akaike gives optimal lag as 1 and at 1lag, null of no cointegration is rejected with F(1,131)=20.22.
similarly Δlrbm= 0.37Δinf(-1)+0.018EC(-1)and at 1 lag null of no cointegration is rejected at F(1,131)=5.84

Here in addition to the variables used for explaining real base money, i.e treasury bill rate, inflation, change in exchange rate and real gnp, deposit rate(mdeprate) is used for the own rate. Not using this variable, would not get rid of autocorrelation. Mdeprate is found to be integrated I(1) (Table II), hence it enters the cointegration equation as is. VAR sequential reduction procedure for lag length selection gives 9 lags as optimal. In a sense there are 2 own rates here, deposit rate and change in exchange rate both of which come up as positive, due to existence of TL deposits as well as foreign currency deposits in the definition of M2Y. The other signs for alternative returns such as mtbill and inflation are negative, which is in accordance with portfolio theory. Here the magnitudes indicate that exchange rate change has a bigger elasticity than both the deposit rates and treasury bill rates and income elasticity is significantly not different than 1 and among the opportunity cost variables inflation has the biggest elasticity with –1.3. Weak exogeneity test results indicate that both interest rates are weakly exogenous while inflation and real M2Y are endogenous.

IV A) THE SHORT RUN DYNAMICS

The alpha coefficient for short run inflation equation is negative, significant and bigger than that of the real base money with –0.870 indicating a faster adjustment through inflation to a disequilibrium in money market in the long run than that of real base money. This probably is due to existence of foreign exchange deposits in M2Y and the fact that change in exchange rate is one of the driving forces behind inflation as well as foreign exchange deposits.

$$\Delta INF = -0.87[EC]_{t-1} - 0.42[\Delta\Delta LEXF]_{t-1+} \underset{(-2.431)}{0.65[\Delta MTBILL]_{t-2}} \underset{(-3.227)}{-0.37[\Delta\Delta LEXF]_{t-2}} + \underset{(2.215)}{0.63[\Delta MTBILL]_{t-3}}$$
(-4.30) (-3.29)

$$\underset{-(2.539)}{-0.27[\Delta\Delta LEXF]_{t-3}} + \underset{(2.37)}{11.074\,[\Delta LRGNP]_{t-3}} \underset{(-2.812)}{-0.257[\Delta\Delta LEXF]_{t-4}} + \underset{(2.849)}{1.916[MDEPR]_{t-6}} + \underset{(2.162)}{0.685[MTBILL]_{t-6}}$$

$$\underset{(-2.156)}{-0.428[\Delta INFF]_{t-6}} + \underset{(3.076)}{2.061[MDEPR]_{t-7}} + \underset{(3.393)}{1.019[MTBILL]_{t-7}} \underset{(-2.982)}{-.555[\Delta INFF]_{t-7}} + \underset{(2.136)}{9.842\,[\Delta\, LRGNP]_{t-7}}$$

$$\underset{(-4.336)}{-0.622[\Delta INFF]_{t-8}}$$

V. CONCLUSION

The findings of this study regarding joint endogeneity of inflation and real base money does not support the possibility of monetary targeting for Turkey and can be thought to give as an indirect support for the alternative targeting regimes instead. However, between the two other choices, namely exchange rate targeting which has been tried before and ended up in a disaster and inflation targeting, the latter has a better chance, even though the conditions for it are still not ready due to fiscal dominance, even though the Central Bank independence and the IMF programs after the crisis in 2000-2001 increased the governments consciousness on fiscal discipline. The fact that treasury bill rate comes out as weakly exogenous, indicate that it is not determined by the variables in money demand equations, including inflationary expectations, but by variables outside the model such as domestic debt stock, risk premium and the like. Even though the increase in debt stock in Turkey in 2000 was due to the banking crisis and the duty losses of public banks which was hidden under the rug until that period,

still the ability to roll over domestic debt maybe problem given the political developments regarding Cyprus and EU negotiations. Meanwhile, cointegration results indicate the existence of a stable long run real base money and the resulting inflation equation has significant error correction term and lag of real base money growth, past values of change in inflation and change in exchange rates as the determinants of inflation. Also, Granger causality test indicates a bivariate causality between change in inflation and real base money growth at 1 lag. Even though, the speed of adjustment in short run inflation equation from M2Y cointegration shows a faster adjustment of inflation to a disequilibrium in money market, still the Central Bank's ability to control M2Y is much less than that of base money with the reserve requirement and liquidity requirement tool in its hands, while it can hardly change exchange rates in a floating regime, unless there is obvious speculative positions and the Central Bank has to intervene in the foreign exchange market, which is not an everyday operation. Also, cointegration relation comes up only at the 90% for real M2Y, while for base money it is true at 95% and even at 99%. Hence for all practical purposes and also given that real base money is cointegrated with real m2y at 90% (appendix), it is better to target and also keep an eye on the developments of base money till the conditions for inflation targeting mature and maybe even after that.

APPENDIX

TABLE I
Tests For Stationarity of Real Base Money Variables

r	DGF	CHISQ-5	LRBM	MTBILL	INFF	ΔLEXF	LRGNP
1	1	9.40	30.11	28.21	26.84	25.07	30.21

Test for Stationarity of Real M2Y Variables

r	DGF	CHISQ-5	LRM2Y	MDEPRATE	MTBILL	INFF	ΔLEXF	LRGNP
1	1	9.40	30.11	36.09	28.21	26.84	25.07	30.21

TABLE II
UNIT ROOT TESTS

	VARIABLES	**ADF**	**Lags**	**Constant**	**Trend**	**Critical Values**
	First differences					
1	ΔInff	-4.28	13	Yes		-2.88
2	ΔΔlexf	-5.45	13	Yes		-2.88
3	Δmtbill	-6.11	5	Yes		-2.88
4	Δmdeprate	-9.27	1	Yes		-2.88
5	ΔLRrerm	3.68	13	Yes		-3.45
6	ΔLRem2y	-3.34	13	Yes		-3.45
7	ΔLRGNP	-3.34	13	Yes		-3.45
	Levels					
1	Inff	-1.15	13	Yes	No	-2.885
2	Δlexf	-2.44	13	Yes	No	-2.885
3	mtbill	-1.95	5	Yes	No	-2.883
4	mdeprate	-2.57	1	Yes	No	-2.883
5	LRrerm	-2.02	13	Yes	Yes	-3.45
6	Lrem2y	0.056	13	Yes	Yes	-3.47
7	LRGNP*	-2.44	13	Yes	No	-3.45

* Seasonal unit root test for LRGNP according to Frances methodology indicate that while $\pi_1=0$, π_2..... $\pi_{12} \neq 0$, which implies there is only non seasonal unit root i.e. the serie is I(1).

Table II indicates that the variables used in real base money as well as real m2y cointegration are all I(1).

TABLE III
TESTS OF THE COINTEGRATING RANK For LRBM

E igenv	Trace	Ho: r	p-r	Trace 99%	Trace 95%
0.2320	69.11	0	5	66.705	59.23
0.1178	33.21	1	4	45.99	39.71
0.0863	16.16	2	3	29.194	24.08

TESTS OF THE COINTEGRATING RANK For LRM2Y

E igenv	Trace	Ho: r	p-r	Trace 90%
0.3032	111.43	0	6	97.17
0.1349	62.3	1	5	71.66
0.0863	42.58	2	4	49.91

TESTS OF THE COINTEGRATING RANK BETWEEN LRBM and LRM2Y

E igenv	Trace	Ho: r	p-r	Trace 90%
0.0674	17.92	0	2	17.79
0.0249	3.43	1	1	7.50

TABLE IV
TEST FOR WEAK-EXOGENEITY: for LRBM LR TEST CHISQ(r)

r	DGF	CHISQ-5	LRBM	MTBILL	INFF	ΔLEXF	LRGNP
1	1	3.840	4.18	1.78	3.91	3.92	3.51

TEST FOR WEAK-EXOGENEITY: for LRM2Y LR TEST CHISQ(r)

r	DGF	CHISQ-5	LRM2Y	MDEPRATE	MTBILL	INFF	ΔLEXF	LRGNP
1	1	3.84	5.04	1.17	0.12	12.41	3.85	0.81

DIAGNOSTICS For Real Base Money

Autocorrelation Results:
L-B(34) CHISQ(495) = 271.078 p val = 0.44
LM (1) CHISQ(25) =18.506 p val = 0.91
LM(4) CHISQ(25) = 18.506 p val = 0.82

Test For Normality
CHISQ(10) = 25.293 p-val =0.00

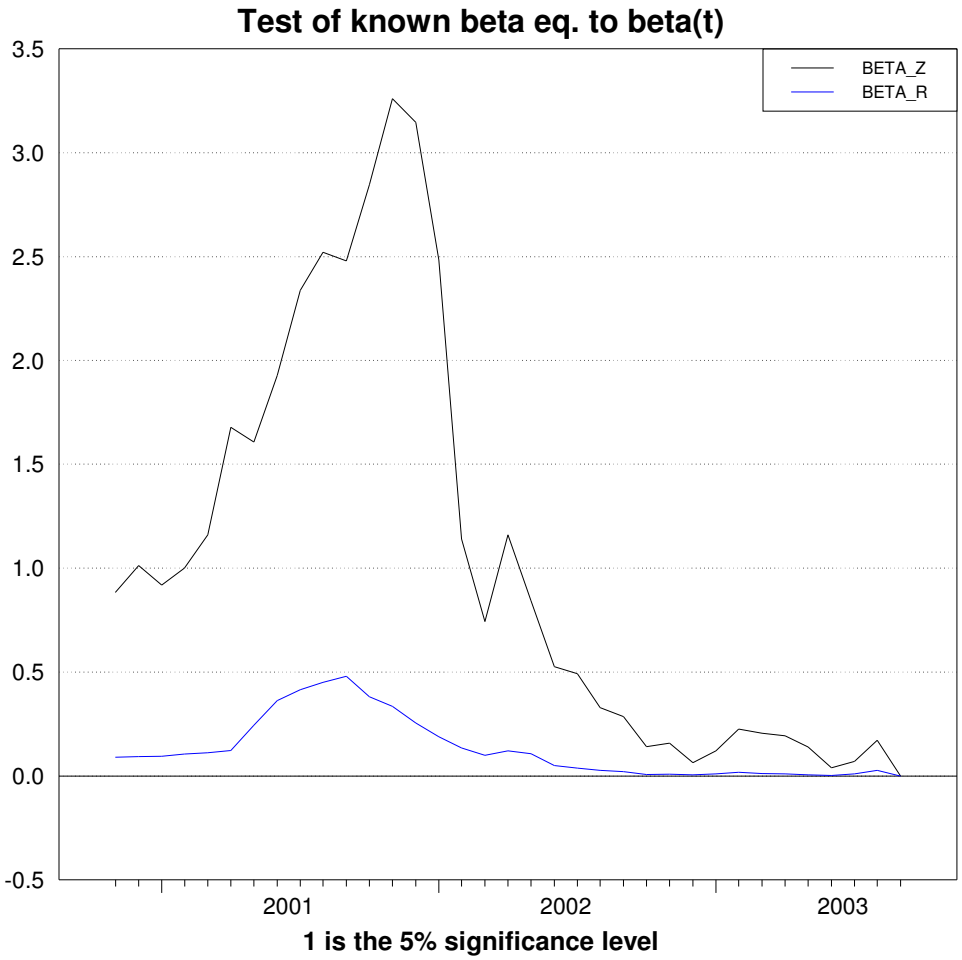
For Short Run Inflation equation:
Arch(15)=2.827 Normality=50.384, Rsquared=0.789

DIAGNOSTICS For Real M2Y

Autocorrelation Results:
L-B(34) CHISQ(930) = 349.992 p val = 0.12
LM (1) CHISQ(36) =33.796 p val = 0.57
LM(4) CHISQ(25) = 41.893 p val = 0.23

Test For Normality
CHISQ(12) = 146.072 p-val =0.00

For Short Run Inflation equation:
Arch(9)=0.449, Normality=61.564, Rsquared=0.731



REFERENCES:

Altimari, N.S.(2001), "Does Money Lead Inflation in the Euro Area", ECB Working Paper No:63

Ando A. and K.Shell (1975), "Demand for Money in a General Portfolio Model in the Presence of Asset that Dominates Money" in Fromm G. and Klein L.(eds.) The Brookings Model: Perspective and Recent Developments, 560-563

Baba Y.,Hendry D. and R.Starr(1992), "The Demand for M1 in the USA,1960-1988, Review of Economic Studies 59, 25-61

Baltensperger E, T. Jordan and M. Savioz (2001), "The Demand for M3 and Inflation, Forecast: An Empirical Analysis for Switzerland" Volkswirtschaftliche Abteilung, Discussion Paper 007

Beaulieu J.J and Miron J.A(1993), "Seasonal Unit Roots in Aggregate U.S data" Journal of Econometrics 55,305-328

Bernanke, B.S, Laubach T, Mishkin F.S and A. Posen (1999), Inflation Targeting: Lessons from International Experience; Princeton University Press, Princeton, New Jersey

Calzo A. Gerdesmeier D and J.Levy (2001), "Euro Area Money Demand: Measuring Opportunity Cost Appropriately"; IMP WP/01/179

Copelman M.(1996), "Financial Innovation and the Speed of Adjustment of Money Demand: Evidence from Bolivia, Israel and Venezuela", International Finance Discussion Papers No 567

Dickey D.A. and S.G. Pantula(1987), "Determining the Order of Differencing in Autoregressive Process" Journal of Business and Economic Statistics 5; 455-461

Estrella A. and F.S. Mishkin(1997), "The Predictive Power of Term Structure of Interest rates in Europa and the United States: Implications for the European Central Bank" in European Economic Review, Vol 41, pp 1375-1401

Fernandez, R.B.(1981), " A Methodological Note on the Estimation of Time Series" Review of Economics and Statistics" 63, 471-476

Frances, P.H (1990), "Testing for Seasonal Unit Roots in Monthly data", Report No 9032/A, Econometric Institute, Erasmus University Rotterdam

Granger C.W.J (1986b), "Developments in the Study of Cointegrated Economic Variables", Oxford Bulletin of Economics and Statistics

Granger C.W.J.(1988), "Some Recent Developments in a Concept of Causality", Journal of Econometrics, 39, 199-211

Gonzalo J. (1994), "Five Alternative Methods of Estimating Long Run Equilibrium Relation", Journal of Econometrics, 60,

Hansen H. and S. Johansen(1993), "Recursive Estimation in Cointegrated Var Models", Institute of Mathematical Statistics, University of Copenhagen

Kivilcim Metin(1998), " The Relationship Between Inflation and Budget Deficit in Turkey", Journal of Business and Economics Statistics, October 1998,Vol 16, No 4

Koru A.T& Ozmen E.(2003), "Budget Deficit, Money Growth and Inflation: The Turkish Evidence", Applied Economics;35, 591- 596

Laidler D.(1985), The Demand for Money: Theory and Evidence; Scranton

Siriram S.S.(1999), "Survey of Literature on the Demand for Money: Theoretical and Empirical Work with Special Reference to Error Correction Models" IMF WP/99/64

Soderstrom U.(2001), "Targeting Inflation with a Prominent Role for Money" Sveriges Riksbank; WP series 123

Svensson, L.E.O(1999), "Money and Inflation in the Euro Area: A Case for Monetary Indicators" BIS WP 98

Ozatay F.(1997), "Sustainability of Fiscal Deficits; Monetary Policy and Inflation Stabilization: The Case for Turkey", Journal of Policy Modeling 19(6), 661-681